Space Weather Forecast

Issued on Saturday, 22 April 2023 at 01:29 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Major geomagnetic storm likely Monday 24 April. Else chance of R1/R2 radio blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity rose to moderate in the UTC day of Friday 21 April, with a late moderate-class X-ray flare at 21/1812UTC on an otherwise quiet trace. The peak flare emanated from a large centrally-located flare and 'filament eruption' combination.

The filament in question formed part of a longer feature that spanned near 20 degrees solar longitude, and although much of this was significantly disturbed, the eastern portion at least appears to have remained in place on the Sun. The resulting Coronal Mass Ejection (CME) was clearly visible in subsequent satellite imagery. The bulk of ejecta was apparently directed south and west of the Sun-Earth line.

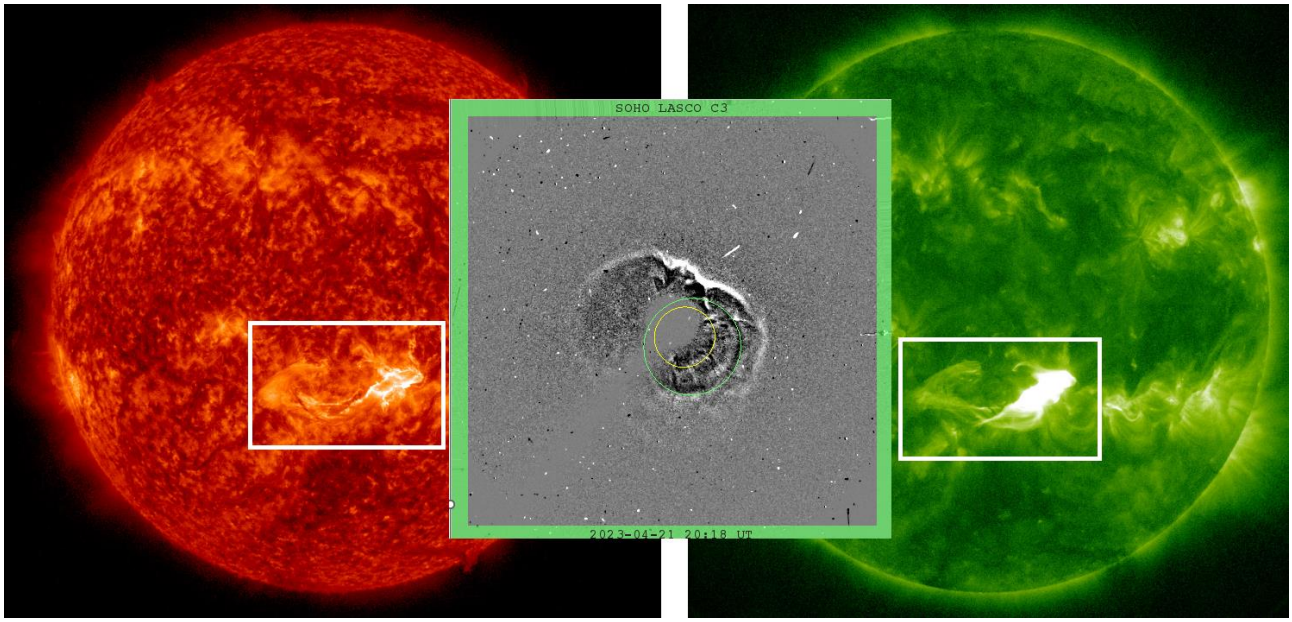

Figure 1: False colour extreme UV imagery of the large flare and filament (boxed left and right images), with a nested difference image showing the resulting CME. This feature is expected to arrive at Earth in the UTC day of Monday 24 April and potentially deliver a G3 Major Geomagnetic Storm.

The above region was one of up to five on the current facing side of the Sun, with an earlier spot group now no longer distinct in the southwest, but potentially replaced by another near the southeastern solar horizon. All of the sunspot groups on the Earth-facing side were either stable or in decay, including the largest in the northwest. This showed apparent areal decay as well as a

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fading of some of its intermediate spots.

Other events in satellite imagery included a high latitude northwest-directed narrow CME, and a western limb event, however neither is expected to affect Earth. Discussion around a 'ghost' CME from a 'coronal hole' realignment prior to this reporting period is now in all likelihood rendered moot by the 21/1812UTC centre-disc filament.

Solar Wind / Geomagnetic Activity: The solar wind was suggestive of a slow solar wind regime. The solar wind speed was roughly level at Background values, while the number of particles and their associated magnetic field were stable and small-scale. The north-south component of the field was mainly co-aligned with Earth's prior to 21/1315UTC (to lesser effect), and mainly anti-aligned thereafter.

The net effect of the above solar wind measures was mostly quiet - well below G1 Minor Geomagnetic Storm throughout, but with a slight increasing trend observed.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity carries a chance of isolated Moderate activity, mainly due to the largest sunspot group but perhaps also from the new region rotating onto the southeast. No regions leave the Sun in the period.

Solar Wind / Geomagnetic Activity: The large full-halo CME from the 21/1812UTC Moderate class flare and filament is due to arrive at the start of the UTC day of Monday 24 April. The 15 April filament CME is now overdue and is only likely to manifest as a density enhancement if present given the length of time it has spent in transit. This has suitably moderated any effects expected.

Earth is otherwise in a slow regime at present. There is a chance of a coronal hole fast wind affecting Earth in the next 36 hours, with wind speeds perhaps reaching elevated levels, although this aspect carries low confidence, and a slow regime could equally persist throughout.
A G3 Major Geomagnetic Storm is considered Likely on Monday 24 April from the 21/1812UTC flare and filament. A G1/G2 is Expected, and there is some bleeding of these probabilities into neighbouring UTC days. Otherwise, there is a Slight Chance of G1 over the current UTC weekend - the result of any surviving 15 April CME material and/or the negative coronal holes.

Energetic Particles / Solar Radiation: No solar radiation storms have been observed - including from the latest moderate-class X-ray flare - and proton counts should persist at Background levels, although there is a slight chance of S1 or greater, mainly due to the largest sunspot, and initially bolstered on Saturday 22 April by any late response to the moderate class flare.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	20	80	30
Strong	G3	No	1	10	60	1
Severe	G4	No	1	1	10	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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